Type and management of zygomaticomaxillary complex fractures In motorbike accidents

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ABSTRACT

Background: Zygomatic bone fractures occur commonly due to its prominent position. Road traffic accidents are leading cause of these fractures in the developing countries. The study aims to determine the common types of zygomatic complex fractures in motorbike accidents and different treatment options used for their management.

Methodology: This study was conducted in the department of Oral and Maxillofacial surgery, Khyber College of Dentistry, Peshawar, from Jan 2015 to March 2017. Total of 240 patients who suffered zygomatic bone fractures from motorbike accidents were included in studies. Patterns were classified into six types based on Knight and North classification.

Results: The mean age of the patients included in this study was 25.8±10.3 years. The most common type was Type IV (40.4%) followed by Type V (27.9%) whereas least common type was Type I (2.1%). All the type I fractures were managed conservatively while type II were treated with reduction only. Type III fractures were mostly treated by 1 point fixation, type IV and V mostly by 2 point and type VI with 3 point fixation.

Conclusion: Men in their 3rd decade of life commonly suffer from zygomatic bone fractures due to motorbike accident. The most common patterns in these fractures are medially rotated (type IV) and laterally rotated body fractures (type V) that required at least 2 point fixation for their optimum management.

Keywords: type, management, zygomaticomaxillary fractures, motorbike accidents.

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INTRODUCTION

Fractures of the maxillofacial region are common because of its anatomically prominent position and fragile bones.[1] These fractures are often associated with functional, aesthetic, psychological compromise and significant financial cost.[2] The zygomatic bone contributes to the formation of floor of the orbit and its lateral wall, the malar eminence, and the zygomatic arch and thus plays a vital role in the form, function and aesthetic appearance of the face.[3] It articulates with the frontal bone, temporal bone, sphenoid bone and maxillary bone, forming a tetrapod structure.[4] Because of its prominent position and convex shape, zygomaticomaxillary complex (ZMC) fractures are one of the most commonly encountered facial fractures second only to nasal bone fractures.[3,5] The ZMC fractures can result in significant cosmetic and functional disturbances because of its relation to the orbit and coronoid process of mandible.[6] These injuries often disrupts the orbital skeleton and cause injury to the eyes.[7] ZMC fracture can present a variety of signs and symptoms that include facial, peri-orbital swelling, ecchymosis, flattening of cheek, subconjunctival hemorrhage, disturbed sensations in the area supplied by infraorbital nerve, enophthalmos, double vision, limited mouth opening and disturbed occlusion.[2,8] Patterns of ZMC fractures range from simple to complex and from non-displaced to grossly displaced patterns depending on the cause and force involved in the injury.[9] Because of the prominent anatomic position of this area even very little displacement can result in functional and esthetic compromise.[10] Diagnosis of ZMC fractures is based on history, clinical examination,confirmed by plain radiographs and computed tomography.[11] Depending on different patterns various treatment modalities have evolved which range from conservative non-surgical management to complex open reduction and internal fixation (ORIF) of at least one, two, three or four points, depending on the displacement and rotation of the segment. Generally, nondisplaced fractures are treated

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conservatively while displaced fractures are surgically reduced and stabilized.[4,9]

The causes of ZMC fracture may vary among different countries depending on local cultural and environmental factors, and include road traffic crashes, interpersonal violence, fall, industrial accidents, sports related and gun-shot injuries.[8,9,12] RTA is the most common etiology ZMC fractures in Pakistan. Motorcycle accidents account for a large proportion of road traffic accidents in Pakistan and motorcycle riders are more vulnerable to road injuries because of the lack of safety gadgets in these vehicles. The motorcycle is known as the most dangerous motor vehicle because for each mile that vehicle passes, motorcycle riders have a 34-times higher risk of death and the chance of injuries is eight times more compared to other vehicles.[13] The motorcycles have become popular mode of commercial use as well as personal transport due to low fuel consumption, easy maintenance and affordable price for low income individuals and students.[12,13]

A lot of controversies exist about the etiology and management of ZMC fractures in the literature. The role of RTAs in ZMC fractures is well established in this part of the world but the impact of motorbike accidents on the severity of ZMC fractures is little explored. This study focuses on the complexity of ZMC fractures due to motorbike accidents and the treatment options used for its definite management. The findings will give an idea about the patterns of ZMC fractures expected in motorbike accidents and help the surgeons formulate an optimal treatment plan to manage these different patterns.

METHODOLOGY

This descriptive observational study was conducted at Khyber College of Dentistry, Peshawar from January 2015 to March 2017. Patients were recruited from the out-patient and in-patient department of Oral & Maxillofacial surgery unit. A total of 240 patients with ZMC fractures due to motorbike accidents were observed. After obtaining approval of the ethical committee of the institution, written informed consents of the patients were taken. All the motorbike riders, irrespective of age, presented with isolated ZMC fractures were included in this study. Motorbikes having pillion passengers, patients presenting two weeks or more after trauma and previously treated ZMC fractures were excluded from the study. Detailed history and clinical examination was carried out to assess the type of ZMC fractures. The patterns of fracture were confirmed using computed tomography scan. All cases requiring surgical management were treated out under general anesthesia using naso-tracheal intubations. A structured proforma was used to record the patients' name, age, type of fracture and the treatment option used. Type of ZMC fractures were based on Knight and North's[14] classification that include type I undisplaced fractures, type II zygomtic arch fracture only, Type III unrotated body fracture, type IV medially rotated body fractures, type V laterally rotated boy fractures and type VI complex fractures. Different treatment options 'used included no intervention, reduction only, 1 point fixation, 2 points fixation, 3 points fixation, 4 points fixation and internal fixation with orbital floor reconstruction. Internal fixation was done using titanium miniplates and microplates. Undisplaced fractures were managed conservatively with soft diet and instructions to avoid pressure on the fractured site and put on a periodic follow up while isolated arch fractures were treated with reduction/elevation only. Reduction/elevation was done using intraoral buccal sulcus approach. Simple descriptive statistics were used to analyze the data by using the Statistical Package for Social Sciences version 20.0 software. The qualitative variables like the type of ZMC fractures and treatment options were presented as proportions and percentages and quantitative variables like age were presented as means and standard deviation.

RESULTS

The mean age of the patients was 25.8±10.3 years. The most common age group was 21 to 30 years followed by 11 to 20 yrs age group. The details of different age groups are given in table 1.

Most of the motorbike accidents occur due to collision with another vehicle (n=193) followed by fall (n=29) and collision with an object (n=18).

The most common type of ZMC fractures observed in motorbike accidents was medially rotated body fractures (40.4%) followed by laterally rotated body fractures (27.9%) while the least common type was undisplaced fractures (2.1%). Details of different patterns of ZMC fractures are given in table 2.

Table 1 - Distribution of Age Groups

Age groups	Frequency	Percent (%)
11-20	64	26.7
21-30	114	47.5
31-40	38	15.8
41-50	15	6.3
51 and above	9	3.8
Total	**240**	**100.0**

Table 2 - Type of ZMC fractures

Pattern	Frequency	Percent (%)
Type I	5	2.1
Type II	8	3.3
Type III	40	16.7
Type IV	97	40.4
Type V	67	27.9
Type VI	23	9.6
Total	**240**	**100.0**

Table 3 - Patterns of ZMC fractures

Treatment options	Frequency	Percent (%)
Observation	5	2.1
Reduction/Elevation Only	27	11.3
One Point Fixation	71	29.6
Two Point Fixation	89	37.1
Three Point Fixation	35	14.5
Four Point Fixation	9	3.7
ORIF with floor reconstruction	4	1.7
Total	**240**	**100.0**

Table 4 - Treatment options used for different Patterns of ZMC fractures

Treatment options	Type I n=5	Type II n=8	Type III n=40	Type IV n=97	Type V n=67	Type VI n=23	Total
Observation	100.0%						2.1%
Reduction/Elevation Only		100.0%	42.5%	2.1%			11.2%
1 Point Fixation			57.5%	47.4%	3.0%		29.6%
2 Point Fixation				50.5%	55.2%	13.0%	37.1%
3 Point Fixation					37.3%	43.5%	14.6%
4 Point Fixation					1.5%	34.8%	3.8%
ORIF With Floor Reconstruction					3.0%	8.7%	1.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The most common treatment performed was two point fixation followed by single point fixation. The details of treatment done are given in table 3.

Undisplaced fractures were treated conservatively while arch fractures were treated with close reduction only. The details of treatment modalities for different patterns are given in table 4.

DISCUSSION

The rise in the motor-bike use during last few decades coupled with rash driving and disregard to traffic rules has resulted in a sharp rise in RTA resulting in gross injuries and even death in some cases. Many studies highlighted the role of RTAs as a cause of ZMC fractures.[2,8,15] Recently, motorcycles have become very popular as a means of public transportation in Pakistan due to the heavy traffic and lack of public transport network in the country. In this study we observed 240 patients with ZMC fractures due to motorbike accidents and all of them were men, as females due to cultural and religious reasons do not ride bikes in Pakistan. The most common age group was 3rd decade of life followed by 2nd decade. Similar high incidence of ZMC fractures in third decade of life was reported in other studies as well.[3,11,16,17] This high incidence of ZMC fractures in 3rd decade can be explained by the fact that this age group is mostly involved in outdoor activities and go out for work or study that require them to move swiftly from one area to another through heavy traffic and as such are predisposed to road traffic crashes.

The most common type of ZMC fractures observed in motorbike accidents was medially rotated body fractures (36.2%) followed by laterally rotated body fractures (24%) while the least common pattern was undisplaced fractures (3.5%). Aguair et al[18] and Young Ji et al[15] also found medially rotated body fractures as the most common pattern and RTA as the main etiology in their studies. However, in a study done in India, Senthikumar et al[19] found type III as the most commonly occurring pattern followed by type IV while RTAs accounted for 67% of these fractures. Similarly, Ugboko et al[20] also found type III (unrotated body fractures) as the most common pattern (35%) followed by type II and type VI respectively. Automobile accidents (61.7%) and motorbike accidents (9.4%) were the main causes in their study. The high frequency of type IV and type V in our study can be due to the moderate to high energy involved in motorbike accidents. As the energy involved in motorbike accidents increases, the severity of ZMC fractures increases from undisplaced to displaced, rotated and complex fractures.

The treatment of ZMC fracture is controversial it depends on the circumstances, personal preference and experience of the surgeons; there are different treatment modalities either non-surgical or surgical that ranges from simple closed reduction without any fixation to complex ORIFs. In the last few decades there has been a paradigm shift in the treatment of ZMC fractures from non-surgical conservative, close reduction to open reduction and osteosynthesis with plates and screws fixation. The number of plates and screws depend on the type of fractures and stability after reduction. The most common method used in our study was ORIF where two points fixation (37.1%) was most commonly used followed by one point fixation (29.6%), three point fixation (14.5%), reduction/elevation only (11.3%), conservative treatment (2.1%), four point fixation (3.7%) and orbital floor reconstruction (1.7%). Thus 86.6% of the fractures were treated with ORIF. Similarly, Adam et al[4] used ORIF in 90.6 percent while close reduction was done in only 9.4% patients. Başaran et al[21] in his study treated 74% fractures with ORIF and Dawood et al[22] used ORIF in 76.8% zygomatic bone fractures. Menon et al[23] used two-point fixations in 85.91% of the patient followed by 3 point fixations (11.73%) and 1 point fixation (2.44%). In a study done in Pune, India, Senthikumar et al19 reported 2-point fixation as the most common method of treatment in his study followed by elevation (32%) and conservative treatment (19%).

The undisplaced fractures in our study were treated conservatively (2.1%) while all the isolated zygomatic arch fractures were treated with reduction/elevation only. Ugboko et al[20] in their study also treated all of type I fractures (8.6%) conservatively. Similarly, in a study done in Bangalore, Ashwin et al[9] treated the undisplaced fractures conservatively with periodic follow ups. Nagaprasad et al16 used close reduction to treat 51.92% of the patients with isolated zygomatic arch fractures in their study.

Orbital floor reconstruction with titanium mesh was done in 4 patients (1.7%) in this study. In KAT general hospital of Athens, Greece Krasadakis et al[24] performed orbital floor reconstruction in 17 patients out of the total 143 cases treated for zygomatic complex fractures. In a study done by Olate et al28 in Brazil, 29.6% patients required orbital floor reconstruction.

As the ZMC fractures worsens from type III to type VI in our study the number of fixation point increased where most of the type III fractures were treated with either 1 point fixation or close reduction, type IV with 1 point or 2 point fixations, type V with 2 or 3 point fixations and type VI with 3 or 4 point fixations. Nagaprasad et al[16] also used ORIF for type IV and V fractures. Likewise, Young ji et al[15] in his study also used internal fixation for type III, type IV, type V, and type VI fractures. They used 2-point fixation (72.9%), 1-point fixation (16.0%) and 3-point fixation (11.1%) to treat these fractures. Senthikumar et al[19] also used 2-point fixation to

treat type III, IV and type V fractures and 3-point fixation for type VI fractures. Similarly, Rana et al[25] concluded that 3-point fixation gives better stability in laterally displaced fractures and complex fractures. Parashar et al[26] also recommended 3-point fixation for displaced fractures. Pakistan being an underdeveloped country where the over-burdened public hospitals have limited facilities and the patients visiting these hospitals mostly belong to low and middle socioeconomic class, the treatment of ZMC fractures is done with minimum use of expensive titanium osteosynthesis plates to reduce the cost and general anesthesia duration. This is shown by studies done previously in this part of the world where majority of the patients were treated conservatively without any internal fixation.[11,27] The high frequency of internal fixation in this study can be explained by the moderate to high energy involved in motorbike accidents which result in more complex patterns where close reduction is not sufficient and some form of internal fixation is required to restore the contour and prevent displacement of fracture segments.

CONCLUSION

The patient with ZMC fractures due to motorbike accidents are mostly young men in their 3rd decade of life. The most common type of ZMC fracture in motorbike accident is medially rotated body fractures followed by laterally rotated body fractures and the most common treatment modality for these fracture type is open reduction with two-point fixation. The complex fractures usually require extra fixation points and treated with 3 or 4 plate osteosynthesis in most cases.

REFERENCES

1. Tripathi GM, Sharma D, Gaharwar APS, Gupta R, Shukla D, Shukla V. Analysis of prevalence and pattern of zygomatic complex fractures in north-eastern part of Madhya Pradesh, India. International Journal of Contemporary Medical Research 2016; 3(7): 1878-81.
2. Starch-Jensen T, Linnebjerg LB, Jensen JD. Treatment of zygomatic complex fractures with surgical or nonsurgical intervention: a retrospective study. The Open Dentistry Journal 2018; 12: 377-87.
3. Adam AAD, Zhi ML, Zu Bing L, Xing WZ. Evaluation of treatment of zygomatic bone and zygomatic arch fractures: a retrospective study of 10 years. J Maxillofac Oral Surg. 2012; 11:171-6.
4. Iqbal HA, Chaudhry S. Choice of operative method for management of isolated zygomatic bone fracture: evidence based study. J Pak Med Assoc. 2009; 59: 615-8.
5. Trindade PAK, Vieira EH, Gabrielli MAC, Gabrielli MFR, Pereira Filho VA. Treatment and complications of orbito-zygomatic fractures. Int J Odontostomat. 2012; 6(3): 255–62.
6. Riaz N, Chatha AA, Warraich RA, Hanif S, Chinar KA, Khan SR. Ophthalmic Injuries in Orbito-Zygomatic Fractures. J Coll Physicians Surg Pak. 2014; 24(9): 649-52.
7. Alamgir, Hameed H, Shah MH. Frequency, etiology and characteristics of zygomatic complex fractures. Pak Oral Dent J. 2013; 33(2): 1-10.
8. Ashwin DP, Rohit, Rajkumar GC. A study on assessing the etiology and different treatment modalities of zygomaticomaxillary complex fracture. International Journal of Contemporary Medical Research 2017; 4(6): 1423-30.
9. Bogusiak K, Arkuszewski P. Characteristics and epidemiology of zygomaticomaxillary complex fractures. J Craniofac Surg 2010; 21: 1018-23.
10. Tanrikaly R, Erol B. Comparison of computed tomography with conventional radiograph for midfacial fractures. Dentomaxillofac Radiol. 2001; 32(3): 141-6.
11. Punjabi SK, Rehman HU, Ali Z, Ahmed S. Causes and management of zygomatic bone fractures at Abbasi Shaheed Hospital Karachi. J Pak Med Assoc. 2011; 61: 36-9.
12. Lin MR, Kraus JF. A review of risk factors and patterns of motorcycle injuries. Accid Anal Prev. 2009; 41(4): 710-22.
13. Dinye RD. The significance and issues of motorcycle transport in the Urban areas in northern Ghana. Scient J Rev. 2013; 2: 256-72.
14. Knight JS, North JF. The classification of malar fracture: an analysis of displacement as a guide to treatment. Br J Plast Surg. 1961; 13: 325-39.
15. Young Ji S, Kim SS, Kim MH, Yang WS. Surgical methods of zygomaticomaxillary complex fracture. Arch Craniofac Surg. 2016; 17(4): 206-10.
16. Nagaprasad N, Praveen Harish G, Reddy GSC. Clinical study of isolated zygomatic fractures. International

Journal of Contemporary Medical Research 2016; 3(7): 1983-6.

17. Singh G, Singh P. Current epidemiologic and clinical assessment relating zygomatic bone and zygomatic arch fractures- A 3 year retrospective study. J Adv Med Dent Sci Res. 2017; 5(3):17-20.
18. Aguiar LT, Moraes RB, de Cerqueira Luz JG. Symptomatology of fractures of the zygomatic complex: Analysis of a series of patients. Rev Cir Traumatol Buco-Maxilo-Fac. 2012;12(2):73-80.
19. Senthilkumar R, Prakash S, Anandan H. Analysis of outcome of zygomatic fracture management. Int J Sci Stud. 2017; 5(5): 216-9.
20. Ugboko V, Udoye C, Ndukwe K, Amole A, Aregbesola S. Zygomatic complex fractures in a suburban Nigerian population. Dent Traumatol. 2005; 21: 70–5.
21. Başaran K, Saydam FA, Pilancı O, Sağır M, Güven E. Optimal treatment of zygomatic fractures: a single-center study results. Kulak Burun Bogaz Ihtis Derg. 2016; 26(1): 42-50.
22. Dawood A, Ramat BR, Al-Hakim I. Associated maxillofacial bone fractures with zygomatic complex fracture: experience from a tertiary referral hospital in Riyadh, Kingdom of Saudi Arabia. Egypt J Surg. 2018; 37(2): 244-7.
23. Menon S, Sinha R, Thapliyal G, Bandyopadhyay T. Management of zygoatic complex fractures in a tertiay hospital: A retrospective study. J Maxillofac Oral Surg. 2011; 10(2): 138-41.
24. Krasadakis C, Igoumenakis D, Schoinohoriti O, Mourouzis C, Rallis G. The significance of orbital floor exploration during open reduction of zygomaticomaxillary complex fractures. JRPMS 2017; 1(2): 45-9.
25. Rana M, Warraich R, Tahir S, Iqbal A, Von See C, Eckardt AM, et al. Surgical treatment of zygomatic bone fracture using two points fixation versus three point fixation-a randomised prospective clinical trial. Trials 2012 13:36.
26. Parashar A, Sharma RK, Makkar S. Rigid internal fixation of zygoma fractures: A comparison of two-point and three-point fixation. Indian J Plast Surg. 2007; 40(1): 18-24.
27. Khan S, Khan A, Saifullah, Khitab U, Shah SM. Occurrence and treatment of zygomatic bone fractures. JKCD 2015; 6(1): 13-6.